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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,670	08/08/2003	John Zagaja	PES-0160	1669

23462 7590 07/10/2007
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EXAMINER	
WILKINS III, HARRY D	
ART UNIT	**PAPER NUMBER**
1753	

MAIL DATE	DELIVERY MODE
07/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/604,670	ZAGAJA ET AL.	
	Examiner	Art Unit	
	Harry D. Wilkins, III	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _08 March 2007_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-27 and 30-32_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-27 and 30-32_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _08 September 2003_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Applicant's filing of an appeal brief on 8 March 2008 is noted. Although the Examiner does not acquiesce with respect to the rejection grounds based on Carlson et al, further search and consideration has turned up significantly closer prior art to Applicant's claim. Further, since claim 7 was only rejected based on Carlson et al, prosecution is being reopened to add an additional rejection of claim 7 that does not rely on Carlson et al.

2. The objection to the specification with respect to the discussion of figure 12 is withdrawn in view of Applicant's remarks pointing out where figure 12 was discussed in the specification. The objection to the specification with respect to figure 10 is also withdrawn and replaced with the more appropriate objection to the drawings since the reference characters from figure 10 are not discussed in the specification.

3. For clarification, several of the rejection grounds have been withdrawn and/or altered. Thus, Applicant should consider all previous grounds of rejection withdrawn unless presented again below. Of note is that claims 8 and 9 are not rejected utilizing Carlson et al as a primary reference since Carlson et al does not reasonably teach a porosity gradient across the thickness of the support member.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: "118", "120" and "122" from figure 10. Corrected drawing sheets in

compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 30 is recites the limitation "the channel" in line 1. There is insufficient antecedent basis for this limitation in the claim.

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claim 30 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had

possession of the claimed invention. The specification as filed fails to support the feature that the channels (e.g.-102 from figure 4) are formed between the first portion of the support member and the second portion of the support member. The relevant disclosure appears on pages 22-23 of the specification as filed. The "first major surface 98" of the "first portion 92" contained the channels, and the "first major surface 98" is described (in the context of figure 3) as the "upper surface", and thus, the side of portion 92 facing opposite the membrane. Further, it should be noted that the naming convention in the claims and the specification are different, in that the portion opposite the membrane electrode assembly (76) is referred to as the "second portion" or "third portion" in the claims, but as the "first portion 92" in the specification.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1-8, 14-25, 27, 31 and 32 are rejected under 35 U.S.C. 102(a) or 102(e) as being anticipated by Shiepe et al (US 7,166,382 and WO 02/27846).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

However, as noted above, this reference also has an PCT publication equivalent which qualifies as prior art under 35 USC 102(a). Thus, Applicant must provide a showing under 37 CFR 1.131 to antedate the publication date of WO02/27846.

[All column and line number references apply to US 7,166,382 to reduce confusion.]

Shiepe et al anticipate the invention as claimed. Shiepe et al teach (see abstract, figures 3-4 and col. 6, line 45 to col. 11, line 35) an electrochemical cell include first and second electrodes separated by a membrane and a sintered metal porous support layer (col. 6, lines 60-64), wherein the porosity of the support changes from a first face facing the membrane to the second face opposite the membrane (col. 10, lines 25-42).

Regarding claims 2-6, Shiepe et al teach (see col. 12, lines 17-26) that the porosity of the sintered porous support was in the range of 10% to 80% and preferably about 40% to 50%, and (see col. 10, lines 25-42) that the porosity adjacent the membrane was lower than the porosity opposite the membrane.

Regarding claim 7, the sintered porous support of Shiepe et al included a third layer arranged adjacent the second layer on the side opposite of the first portion, wherein the porosity of the third layer was less than the porosity of the second layer.

Regarding claim 8, Shiepe et al teach (see col. 10, lines 25-42) that the sintered porous support comprised a plurality of layers, wherein each layer has a porosity greater than or equal to a previous layer.

Regarding claim 14, Shiepe et al teach (see figure 3 and col. 10, lines 25-42) including a pressure pad (330) adjacent the support member.

Regarding claims 15-18, Shiepe et al teach (see col. 13, lines 5-10) that the sintered porous supports (with porosity gradient) were known to be utilized on both sides of the electrochemical cell, such that the second support member was arranged adjacent to the second electrode.

Regarding claim 19, Shiepe et al teach (see figure 3 and col. 10, lines 25-42 and col. 6, lines 60-64) that the porous support was made from sintered metal powder. Sintered metal powder is electrically conductive. Therefore, the sintered porous support (in intimate contact with electrode 306) would have also acted as an extension to the first electrode.

Regarding claims 20 and 27, Shiepe et al teach (see at least at figure 3) an electrochemical cell including first (306) and second (304) electrodes disposed on either side of a membrane (302), a flow field (328) consisting essentially of a sintered porous support member and a pressure pad assembly (330), all arranged in electrical and physical communication with each other.

Regarding claim 21, Shiepe et al teach that the sintered metal porous support layer (col. 6, lines 60-64) was made such that the porosity of the support changes from a first face facing the membrane to the second face opposite the membrane (col. 10, lines 25-42).

Regarding claim 22, Shiepe et al teach (see col. 12, lines 17-26) that the porosity of the sintered porous support was in the range of 10% to 80% and preferably about 40% to 50%, and (see col. 10, lines 25-42) that the porosity adjacent the membrane was lower than the porosity opposite the membrane.

Regarding claim 23, Shiepe et al teach (see figure 3 and col. 10, lines 25-42 and col. 6, lines 60-64) that the porous support was made from sintered metal powder. Sintered metal powder is electrically conductive. Therefore, the sintered porous support (in intimate contact with electrode 306) would have also acted as an extension to the first electrode.

Regarding claims 24-25, Shiepe et al teach (see col. 12, lines 27-41) that the porous supports provided support to the membrane at pressures up to and exceeding 10,000 psi.

Regarding claims 31 and 32, Shiepe et al teach forming the sintered porous support from multiple distinct layers.

11. Claims 1, 7, 8, 9, 15-19 and 31 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381).

Rosenmayer anticipates the invention as claimed. Rosenmayer teaches (see abstract, figure 1 and col. 3, line 40 to col. 5, line 16 and Examples 3 and 4) an electrochemical cell including first (5) and second (not pictured) electrodes on opposite sides of a membrane (6), and a sintered porous support (3,4) having a first porosity on the first side facing the membrane and a second, different porosity on the second side facing opposite from the membrane.

Regarding claim 7, Rosenmayer teaches (see col. 3, lines 48-53) that the porosity gradient occurred either in a step-wise layer fashion or continually. Thus, Rosenmayer teaches making the porous support member with three of more portions having varying porosities.

Regarding claim 8, the support member of Rosenmayer was made of two layers (3, 4) wherein the layer (4) had a porosity greater than the previous layer (3).

Regarding claim 9, Rosenmayer teaches (see col. 3, lines 48-53) that the porosity gradient occurred either in a step-wise layer fashion or continually.

Regarding claims 15-18, Rosenmayer teaches (see col. 5, lines 8-12) that the sintered porous supports (with porosity gradient) were known to be utilized on both sides of the electrochemical cell, such that the second support member was arranged adjacent to the second electrode.

Regarding claim 19, Rosenmayer teaches (see figure 1 and col. 3, lines 48-57) that the sintered porous support was electrically conductive. Therefore, the sintered porous support (in intimate contact with electrode 5) would have also acted as an extension to the first electrode.

Regarding claim 31, Rosenmayer teaches making the porous support member from two distinct layers.

12. Claims 1-7, 13-25 and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Carlson et al (US 5,372,689) with evidence from Shiepe et al (US 7,166,382).

Carlson teaches an water electrolyzer (i.e. electrochemical cell) comprising an anode, a cathode and an ion exchange membrane separating the two electrodes(Fig. 4 numerals 7, 9 and 5, col. 2 line 66-col. 3 line 3). The water electrolyzer further teaches a porous support member having multiple-pore sizes (col. 3 line 49-col.4 line 56).

Thus, the first face of the porous support member, which faces the membrane, includes a first portion having a first pore size, and the second face of the porous support member, which faces away from the membrane, includes a second portion having a second pore size, wherein the first pore size and the second pore size are different.

Shiepe et al teach (see col. 10, lines 36-38) that differing pore (void) sizes results in differing pore (void) volumes. Thus, the areas of differing pore sizes had different porosities, since porosity was a measure of the percent of pore volume to total volume.

At at least some portion of the porous support member of Carlson, the second portion would have had a larger pore size than the first portion, such that the porosity of the second portion would have been more porous (i.e.-higher porosity). It should be noted that the claim does not limit the second portion of the porous support member

being positioned directly adjacent to the first portion on the side opposite of the membrane.

Even though Carlson does not teach that the porous support member is sintered, the electrochemical cell of Carlson meets all the structural limitations of the instant claim. The examiner interprets the term "sintered" as describing how the support member is made, i.e. process limitation. Therefore, the claimed limitation of "sintered" support member does not lend patentability to the instant apparatus claim.

Regarding claims 3-6, Carlson further teaches that the porosity of the porous support member ranges from about 40% to about 60%. Therefore, the pores in the support member of Carlson having a porosity of about 40-50% meet the limitation of the claimed first portion porosity as recited in instant claims 3-4. The pores of the support member of Carlson having a porosity of about 50-60% meet the limitation of the claimed second portion porosity as recited in instant claims 5-6.

Regarding claim 7, since Carlson teaches that the porous support member had multiple pore sizes, each region with one or more different pore sizes reads on the claimed first, second and third portions. Therefore, the porous support member of Carlson inherently teaches the claimed third portion having the claimed third portion porosity that is less than or equal to the second portion porosity.

Regarding claim 13, since Carlson's porous support member has multiple pore sizes, the second portion of Carlson's porous support member inherently have the claimed high porosity and lower porosity regions as claimed.

Regarding claim 14, Carlson further teaches that metal screen sets in physical and electrical contact with the porous support member(Fig. 4 numeral 1). The metal screen sets of Carlson read on the pressure pad as claimed.

Regarding claims 15 and 17-18, Carlson further teaches that the porous support member can be disposed on both side of the anode or cathode(col. 4 lines 46-50). Therefore, Carlson teaches the additional porous support as claimed. The additional porous support member as taught by Carlson meets the structural limitation of the instant claims 17-18 for the same reason as stated in the rejections of instant claims 1-2 above.

Regarding claims 16, 19 and 23, Carlson et al teach that the porous support member (see col. 4, lines 1-2) that the porous support member was made form electrically conductive material and (see figure 4) was in intimate contact with the electrode. Therefore, the porous support would have also acted as an extension to the electrodes.

Regarding claim 20, Carlson's electrochemical apparatus comprises the claimed first and second electrodes, the claimed ionic membrane, the claimed porous support member and the claimed pressure assembly. In addition, since Carlson teaches the claimed porous support member, Carlson inherently teaches the claimed flow field.

Regarding claim 21-22, the instant claims are rejected for the same reason as stated in the rejection of instant claims 1-2 and 17-18 above.

Regarding claims 24-25, Carlson further teaches that the electrochemical cell is capable of operating at a pressure gradient of up to about 2000psi and greater (col. 2

lines 66-68), which meets the claimed pressure limitations as recited in instant invention.

Regarding claim 27, the instant claim is rejected for the same reason as stated in the rejection of instant claim 14 above.

13. Claims 1-6, 8, 15, 17-18 and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Gorman et al (US 2002/0086195).

Gorman teaches an electrochemical cell comprising first and second electrode separated by an ionic membrane(Fig. 2, numerals 42a, 38a and 40a), and a bilayer electrode support member on both side of the electrodes(fig. 2 numerals 44a and 46a), the bilayer electrode support member comprising a fine pore layer with 50% porosity and a coarse pore layer with 65-75% porosity(page 2 paragraph 13).

Regarding claims 1-2, the finer layer of the bilayer support member as taught by Gorman reads on the claimed first portion of the porous support member. The coarse layer of the bilayer support member as taught by Gorman reads on the claimed second portion of the porous support member.

Even though Gorman does not teach that the bilayer porous support member is sintered, the electrochemical cell of Gorman meets all the structural limitations of the instant claim. The examiner interprets the term "sintered" as describing how the support member is made, i.e. process limitation. Therefore, the claimed limitation of "sintered" support member does not lend patentability to the instant apparatus claim.

Regarding claims 3-4, the finer layer of the bilayer support member as taught by Gorman (50% porosity) reads on the claimed first portion porosities of less than or equal

to about 60% as recited in claim 3 and the claimed porosity of about 35% to about 50% as recited in claim 4.

Regarding claims 5-6, the coarse layer of the bilayer support member as taught by Gorman (65-75% porosity reads on the claimed second portion porosity of greater than or equal to about 50% as recited in claim 5 and the claimed porosity of about 50% to about 70% as recited in claim 6.

Regarding claim 8, the bilayer support member includes a plurality of layers wherein each layer has a layer porosity of greater than or equal to a previous layer.

Regarding claim 15-18, Gorman teaches the claimed additional porous support member with the second portion (i.e. coarse layer) having greater porosity than the first portion(i.e. fine layer) on the other side of the membrane as claimed.

Regarding claims 16 and 19, the porous bilayer of Gorman was made from electrically conductive material and was in intimate contact with the electrode. Therefore, the porous support would have also acted as an extension to the electrodes.

Regarding claim 31, the bilayer porous support member as taught by Gorman in view of Shiepe comprises the claimed first and second layers.

14. Claim 20 is rejected under 35 U.S.C. 102(e) as being anticipated by Anderson et al (US 2003/0230495).

Anderson et al teach an electrochemical cell comprising a first electrode, a second electrode and an ionic membrane separating the two electrodes (Fig. 4 numeral 75, 77 and 73). The electrochemical cell further comprises a porous fluid flow field member (Fig. 4 numerals 84 and 74) and a pressure pad (Fig. 4 numeral 71).

Therefore, the apparatus of Anderson meets the structural limitations of the instant invention.

Even though Anderson et al do not teach that the porous support member is sintered, the electrochemical cell of Anderson et al meets all the structural limitations of the instant claim. The examiner interprets the term "sintered" as describing how the support member is made, i.e. process limitation. Therefore, the claimed limitation of "sintered" support member does not lend patentability to the instant apparatus claim.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

16. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shiepe et al (US 7,166,382 and WO 02/27846) in view of Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381).

The teachings of Shiepe et al are discussed above.

However, Shiepe et al do not explicitly teach the claimed singer layer porous support member with porosity gradient.

Rosenmayer teaches (see col. 3, lines 48-57) that changing porosities in a layer can be accomplished either with discrete layers (as in the case of Gorman et al) or by a continuous gradient in one layer.

Therefore, it would have been obvious to one of ordinary skill in the art to have substituted a porous support which had a continuous porosity gradient instead of distinct layers having different porosities as suggested by Rosenmayer since Rosenmayer teaches that the two options are functional equivalents.

17. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gorman et al (US 2002/0086195) in view of Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381).

The teachings of Gorman et al are discussed above.

However, Gorman et al do not explicitly teach the claimed singer layer porous support member with porosity gradient.

Rosenmayer teaches (see col. 3, lines 48-57) that changing porosities in a layer can be accomplished either with discrete layers (as in the case of Gorman et al) or by a continuous gradient in one layer.

Therefore, it would have been obvious to one of ordinary skill in the art to have substituted a porous support which had a continuous porosity gradient instead of distinct layers having different porosities as suggested by Rosenmayer since Rosenmayer teaches that the two options are functional equivalents.

18. Claims 10-12, 26 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shiepe et al (US 7,166,382 and WO 02/27846) in view of Wilkinson et al (US 5,252,410).

The teachings of Shiepe et al are described above.

However, Shiepe et al do not teach forming flow field channels in the support member.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Shiepe et al to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

Regarding claims 11-12, Wilkinson et al teach (see e.g.-figures 11 and 12 and figures 13 and 14) providing flow channels all of which extend from an inlet proximate to an edge of the side, and which end at a terminus either near the center of the side (figures 11 and 12) or at a different edge of the side (figures 13 and 14).

Regarding claim 30, in order to have the reactants as close to the membrane as possible to increase efficiency, it would have been obvious to one of ordinary skill in the art to have placed the channels in the porous layer adjacent to the membrane, rather than in a porous layer furthest from the membrane.

19. Claims 10-12 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381) in view of Wilkinson et al (US 5,252,410).

The teachings of Rosenmayer are described above. Rosenmayer teaches forming flow channels in the current collector plate (1).

Thus, Rosenmayer does not teach forming flow field channels in the support member.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Rosenmayer to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

Regarding claims 11-12, Wilkinson et al teach (see e.g.-figures 11 and 12 and figures 13 and 14) providing flow channels all of which extend from an inlet proximate to an edge of the side, and which end at a terminus either near the center of the side (figures 11 and 12) or at a different edge of the side (figures 13 and 14).

Regarding claim 30, in order to have the reactants as close to the membrane as possible to increase efficiency, it would have been obvious to one of ordinary skill in the art to have placed the channels in the porous layer adjacent to the membrane, rather than in a porous layer furthest from the membrane.

20. Claims 10-12 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carlson et al (US 5,372,689) in view of Wilkinson et al (US 5,252,410).

The teachings of Carlson et al are described above.

Thus, Carlson et al do not teach forming flow field channels in the support member.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Gorman et al to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

Regarding claims 11-12, Wilkinson et al teach (see e.g.-figures 11 and 12 and figures 13 and 14) providing flow channels all of which extend from an inlet proximate to

an edge of the side, and which end at a terminus either near the center of the side (figures 11 and 12) or at a different edge of the side (figures 13 and 14).

21. Claims 10-12 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gorman et al (US 2002/0086195) in view of Wilkinson et al (US 5,252,410).

The teachings of Gorman et al are described above. Gorman et al teach forming flow channels in the current collector plate.

Thus, Gorman et al do not teach forming flow field channels in the support member.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Gorman et al to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

Regarding claims 11-12, Wilkinson et al teach (see e.g.-figures 11 and 12 and figures 13 and 14) providing flow channels all of which extend from an inlet proximate to

an edge of the side, and which end at a terminus either near the center of the side (figures 11 and 12) or at a different edge of the side (figures 13 and 14).

Regarding claim 30, in order to have the reactants as close to the membrane as possible to increase efficiency, it would have been obvious to one of ordinary skill in the art to have placed the channels in the porous layer adjacent to the membrane, rather than in a porous layer furthest from the membrane.

22. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shiepe et al (US 7,166,382 and WO 02/27846) in view of Carlson et al (US 5,372,689).

The teachings of Shiepe et al are described above.

However, Shiepe et al do not teach forming regions on the porous support member having differing porosities.

Carlson et al teach (see col. 3, lines 45-67) that formation of regions, one having large pores and one having small pores, in a porous support member in an electrochemical cell results in increasing the dual-directional flow of reactants and products to and from the membrane, thereby providing adequate support without compromising the efficiency of the electrochemical cell.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated regions having large pores and regions having small pores into the porous support member of Shiepe et al for the purpose of enhancing dual-directional flow of reactants and products to and from the membrane to thereby allow the porous support member.to provide adequate support without compromising the efficiency of the electrochemical cell.

23. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381) in view of Carlson et al (US 5,372,689).

The teachings of Rosenmayer are described above.

However, Rosenmayer does not teach forming regions on the porous support member having differing porosities.

Carlson et al teach (see col. 3, lines 45-67) that formation of regions, one having large pores and one having small pores, in a porous support member in an electrochemical cell results in increasing the dual-directional flow of reactants and products to and from the membrane, thereby providing adequate support without compromising the efficiency of the electrochemical cell.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated regions having large pores and regions having small pores into the porous support member of Rosenmayer for the purpose of enhancing dual-directional flow of reactants and products to and from the membrane to thereby allow the porous support member to provide adequate support without compromising the efficiency of the electrochemical cell.

24. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gorman et al (US 2002/0086195) in view of Carlson et al (US 5,372,689).

The teachings of Gorman et al are described above.

However, Gorman et al do not teach forming regions on the porous support member having differing porosities.

Carlson et al teach (see col. 3, lines 45-67) that formation of regions, one having large pores and one having small pores, in a porous support member in an electrochemical cell results in increasing the dual-directional flow of reactants and products to and from the membrane, thereby providing adequate support without compromising the efficiency of the electrochemical cell.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated regions having large pores and regions having small pores into the porous support member of Gorman et al for the purpose of enhancing dual-directional flow of reactants and products to and from the membrane to thereby allow the porous support member to provide adequate support without compromising the efficiency of the electrochemical cell.

25. Claims 14, 20-25, 27 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenmayer (DE 19840517, with reference to its English equivalent US 6,605,381) in view of Shiepe et al (US 6,365,032).

The teachings of Rosenmayer are discussed above.

However, Rosenmayer does not explicitly teach the claimed pressure pad.

Shiepe et al teach (see figures 2-3) including a pressure pad (e.g.-116, 118) within an electrochemical cell for the purpose of (see col. 4, lines 44-50) to improve fluid distribution to the membrane, lower the voltage required for the electrochemical reaction and provide structural integrity to the membrane and electrode assembly.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated a pressure pad as suggested by Shiepe et al within the electrochemical cell of Rosenmayer to improve the cell operating conditions.

Regarding claims 24-25, since Rosenmayer in view of Shiepe et al teach an electrochemical cell that is structurally substantially the same as that of the instant invention, one of ordinary skill in the art would have found it obvious that the porous member of Rosenmayer in view of Shiepe et al is inherently capable of supporting the membrane at pressure of greater than or equal to about 100 or 500 psi as claimed.

Regarding claim 32, the multi-layer porous support member as taught by Rosenmayer comprises the claimed first and second layers.

26. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenmayer et al (DE 19840517, with reference to its English equivalent US 6,605,381) in view of Shiepe et al (US 6,365,032), as applied above to claim 20 and further in view of Wilkinson et al (US 5,252,410).

The teachings of Rosenmayer in view of Shiepe et al are discussed above.

However, Rosenmayer in view of Shiepe do not explicitly teach the claimed channel.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of

the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Rosenmayer to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

27. Claims 14, 20-25, 27, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gorman et al (US 2002/0086195) in view of Shiepe et al (US 6,365,032).

The teachings of Gorman et al are discussed above.

However, Gorman et al do not explicitly teach the claimed pressure pad.

Shiepe et al teach (see figures 2-3) including a pressure pad (e.g.-116, 118) within an electrochemical cell for the purpose of (see col. 4, lines 44-50) to improve fluid distribution to the membrane, lower the voltage required for the electrochemical reaction and provide structural integrity to the membrane and electrode assembly.

Therefore, it would have been obvious to one of ordinary skill in the art to have incorporated a pressure pad as suggested by Shiepe et al within the electrochemical cell of Gorman et al to improve the cell operating conditions.

Regarding claims 24-25, since Gorman in view of Shiepe teach an electrochemical cell that is structurally substantially the same as that of the instant invention, one of ordinary skill in the art would have found it obvious that the porous

member of Gorman in view of Shiepe is inherently capable of supporting the membrane at pressure of greater than or equal to about 100 or 500 psi as claimed.

Regarding claim 32, the bilayer porous support member as taught by Gorman in view of Shiepe comprises the claimed first and second layers.

28. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gorman et al (US 2002/0086195) in view of Shiepe et al (US 6,365,032) as applied above to claim 20 and further in view of Wilkinson et al (US 5,252,410).

The teachings of Gorman in view of Shiepe are discussed above.

However, Gorman in view of Shiepe do not explicitly teach the claimed channel.

Wilkinson et al teach (see abstract, figures 2-3 and col. 8, line 28 to col. 9, line 40) including channels in a porous electrode/membrane support member for the purpose of distributing reactants to the electrodes. The channels formed in the porous electrode/membrane support member had the advantages of (see col. 3, line 42 to col. 4, line 16) reduced "repeating unit" thickness (increasing the power-to-volume ratio of the fuel cell) and decreasing the distance between the reactants and the electrodes, thereby increasing efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art to have formed channels in the porous support member of Gorman et al to provide adequate circulation of reactants within the fuel cell while achieving a higher power-to-volume ratio and efficiency.

Response to Arguments

29. Applicant's arguments filed 8 March 2007 have been fully considered but they are not persuasive. Applicant has argued that:

a. Carlson et al fail to teach "multiple porosities".

In response, as now evidenced by Shiepe et al (US 7,166,382) regions of differing pore size results in differing porosity.

b. The claims require a sintered porous sheet which does not cover porous sheets not made by sintering.

In response, Applicant has failed to structurally distinguish sintered porous sheets from non-sintered porous sheets. Evidence showing the differences between sintered and non-sintered porous sheets should be submitted to clarify the exact structure produced by the sintering process, such that there is no ambiguity in the scope of Applicant's claim.

c. Anderson et al do not teach a porous flow field member.

In response, although Anderson et al name the parts of the apparatus using different nomenclature than Applicant, does not mean that the structures are any different.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 7:45am-4:15pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Susy Tsang-Foster can be reached on 571-272-1293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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hdw